REMARKS

In sections 1-4 of the Office Action, the Examiner rejected claims 5-8 and 21-24 under 35 U.S.C. §112, second paragraph, as being indefinite. Specifically, the Examiner asserts that the limitation "the equalizer" in claims 5 and 21 has insufficient antecedent basis. Claims 5 and 21 have been amended to overcome this rejection.

In sections 5 and 6 of the Office Action, the Examiner provisionally rejected claims 1-24 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-24 of co-pending Application 2005/0123075 A1.

Section 804 of the MPEP states that, if "provisional" obviousness-type double patenting rejections in two applications are the only rejections remaining in those applications, the examiner should withdraw the obviousness-type double patenting rejection in the earlier filed application thereby permitting that application to issue without need of a terminal disclaimer. A terminal disclaimer must be required in the later-filed application before the obviousness-type double patenting rejection can be withdrawn and the application permitted to issue.

Therefore, it will become clear from the discussion below in relation to the Yousef patent and from the subsequent prosecution of co-pending Application 2005/0123075 A1 that the obviousness-type double patenting rejection of these two applications is realistically the only remaining rejection. Therefore, the obviousness-type double patenting rejection of the claims 1-24 in the earlier filed present application should be withdrawn.

It will also be shown during subsequent prosecution of co-pending Application 2005/0123075 A1 that the claims therein are patentably distinct over claims 1-24 of the present application and that, therefore, no terminal disclaimer should be required in co-pending Application 2005/0123075 A1 either.

In sections 7 and 8 of the Office Action, the Examiner rejected claims 1-24 under 35 U.S.C. §102(e) as being anticipated by Yousef.

Yousef relies on the standard recursive least squares (RLS) algorithm to determine the coefficients g of a decision feedback equalizer (DFE) from a channel estimate h. A fast transversal filter (FTF) algorithm is used in this connection. The complexity of the FTF algorithm is reduced by choosing a length for the

feedback coefficients of the DFE that forces the FTF algorithm to use a lower triangular matrix. The feed forward coefficients of the DFE are then computed by convolving the coefficients g with the channel impulse response h. In performing this computation, a convolution matrix that characterizes the channel impulse response h is extended to a bigger circulant matrix. With the extended circulant matrix structure, the convolution of the coefficients g with the channel impulse response h can be performed in the frequency domain.

Independent claim 1 is directed to a method of processing a received signal y to produce a channel estimate. The received signal y is decoded to form data s. A convolution matrix $\hat{S}$ is formed from the data s, and a matrix F is formed from the data s such that the matrix F results from forming the matrix $\hat{S}$ as a convolution matrix. A conjugate gradient algorithm is performed to determine the channel estimate. The conjugate gradient algorithm is based on the received signal y, the matrix $\hat{S}$, and the matrix F.

The only convolution matrix described in Yousef is the matrix H, which is formed from the channel impulse

response and not from received data. Therefore, Yousef does not disclose the invention of independent claim 1.

The Examiner points to the abstract of Yousef for a disclosure of a convolution matrix formed from received data. However, the abstract of Yousef instead indicates that the convolution matrix is formed from the channel impulse response.

The Examiner also points to elements 104 and y(n) of Figures 7 and 8. However, element 104 of Figure 7 is merely the feed forward filter of the decision feedback equalizer, and y(n) of Figure 8 is merely the received data received from the channel 802 as affected by noise $v(n)$. Thus, there is no disclosure of a convolution matrix here.

The Examiner further points to column 2, lines 65-67, which merely confirm that the convolution matrix H is formed from the channel impulse response.

The Examiner still further points to column 4, lines 45-50, which also merely confirm that the convolution matrix H is formed from the channel impulse response.

The Examiner finally further points to column 12, lines 30-45, which further merely confirm that the

convolution matrix H is formed from the channel impulse response.

Accordingly, because Yousef does not disclose a convolution matrix that is formed from received data, independent claim 1 is not anticipated by Yousef.

Moreover, Yousef does not disclose forming a matrix F from the data s such that the matrix F results from forming the matrix $\hat{S}$ as a convolution matrix. Yousef does disclose forming the matrix $\bar{H}$ from the matrix H. However, the standard notation used in designating matrix $\bar{H}$ indicates that matrix $\bar{H}$ is formed by inverting the matrix H rather than forming the matrix $\bar{H}$ from received data or forming the matrix $\bar{H}$ as a result of forming the matrix H as a convolution matrix.

The Examiner also points to elements 108 and 808 of Figures 7 and 8. However, element 108 of Figure 7 is merely the feedback filter of the decision feedback equalizer, and element 808 of Figure 8 is likewise the feedback filter of the decision feedback equalizer. Thus, there is no disclosure of a convolution matrix here.

The Examiner further points to column 2, lines 65-67, which merely confirm that the convolution matrix H is formed from the channel impulse response and which

mention nothing about forming a matrix as a result of forming the matrix H as a convolution matrix.

The Examiner still further points to column 4, lines 45-50, which also merely confirm that the convolution matrix H is formed from the channel impulse response and which mention nothing about forming a matrix as a result of forming the matrix H as a convolution matrix.

The Examiner finally further points to column 12, lines 30-45, which further merely confirm that the convolution matrix H is formed from the channel impulse response and which mention nothing about forming a matrix as a result of forming the matrix H as a convolution matrix.

Accordingly, because Yousef does not disclose forming a matrix from data and from forming the convolution matrix, independent claim 1 is not anticipated by Yousef.

Independent claim 9 is directed to a method of processing a received signal y by decoding the received signal y to form data s, by forming a convolution matrix $\hat{S}$ from the data s, by forming a matrix F from the data s such that the matrix F results from forming the matrix $\hat{S}$ as a convolution matrix, and by performing a conjugate

gradient algorithm based on the received signal y, the matrix $\hat{S}$, and the matrix F.

Because Yousef does not disclose a convolution matrix that is formed from received data as discussed above, independent claim 9 is not anticipated by Yousef.

Moreover, because Yousef does not disclose forming a matrix from received data and from forming the convolution matrix as also discussed above, independent claim 9 is not anticipated by Yousef.

Independent claim 13 is directed to a method of processing a received signal y by decoding the received signal y to form data s, by forming a convolution matrix $\hat{S}$ from the data s, by forming a matrix F from the data s such that the matrix F results from forming the matrix $\hat{S}$ as a convolution matrix, and by performing a conjugate gradient algorithm based on the received signal y, the matrix $\hat{S}$, and the matrix F. The conjugate gradient algorithm includes forming FFTs based on the received signal y, the matrix $\hat{S}$, and the matrix F, multiplying the FFTs to form a multiplication product, and forming an inverse FFT of the multiplication product.

Because Yousef does not disclose a convolution matrix that is formed from received data as discussed above, independent claim 13 is not anticipated by Yousef.

Moreover, because Yousef does not disclose forming a matrix from received data and from forming the convolution matrix as also discussed above, independent claim 13 is not anticipated by Yousef.

Independent claim 17 is directed to a method of processing a received signal y to produce a channel estimate by decoding the received signal y to form data s, by forming a convolution matrix $\hat{S}$ from the data s, by forming a matrix F from the data s such that the matrix F results from forming the matrix $\hat{S}$ as a convolution matrix, and by performing a conjugate gradient algorithm to determine the channel estimate. The conjugate gradient algorithm is based on the received signal y, the matrix $\hat{S}$, and the matrix F. Also, the conjugate gradient algorithm includes forming FFTs based on the received signal y, the matrix $\hat{S}$, and the matrix F, multiplying the FFTs to form a multiplication product, and forming an inverse FFT of the multiplication product.

Because Yousef does not disclose a convolution matrix that is formed from received data as discussed above, independent claim 17 is not anticipated by Yousef.

Moreover, because Yousef does not disclose forming a matrix from received data and from forming the

convolution matrix as also discussed above, independent claim 17 is not anticipated by Yousef.

Because independent claims 1, 9, 13, and 17 are not anticipated by Yousef, dependent claims 2-8, 10-12, 14-17, and 18-24 are likewise not anticipated by Yousef.

Moreover, there are additional reasons that dependent claims 2-8, 10-12, 14-17, and 18-24 are not anticipated by Yousef.

For example, dependent claims 3, 7, 11, 15, 19, and 23 recite that a matrix S is formed from the data s, that the matrix $\hat{S}$ is formed from the matrix S by setting certain values of the matrix S to zero, and that the matrix F is formed from the matrix S by setting to zero the values of the matrix S not set to zero during forming of the matrix $\hat{S}$.

Yousef does not disclose forming either the matrix $\hat{S}$ or the matrix F in this manner.

The Examiner first argues that Yousef discloses forming the matrix S from received data. Yousef does not. It describes a convolution matrix H formed from the channel impulse response, but it does not describe a convolution matrix formed from received data.

In making this first argument, the Examiner first points to the abstract of Yousef. However, the

abstract of Yousef merely indicates that the convolution matrix H is formed from the channel impulse response.

The Examiner also points to elements 104 and y(n) of Figures 7 and 8. However, element 104 of Figure 7 is merely the feed forward filter of the decision feedback equalizer, and y(n) of Figure 8 is merely the data received from the channel 802 as affected by noise $v(n)$. Thus, there is no disclosure of a convolution matrix here.

The Examiner further points to column 2, lines 65-67, which merely confirm that the convolution matrix H is formed from the channel impulse response.

The Examiner still further points to column 4, lines 45-50, which also merely confirm that the convolution matrix H is formed from the channel impulse response.

The Examiner finally further points to column 12, lines 30-45, which further merely confirm that the convolution matrix H is formed from the channel impulse response.

The Examiner next argues that Yousef discloses forming a matrix $\hat{S}$ from the matrix S by setting certain values of the matrix S to zero. Yousef does not. The formation of the matrix S from received data implies that

the matrix $\hat{S}$ is also formed from received data. However, Yousef merely describes a convolution matrix H formed from the channel impulse response, but it does not describe a convolution matrix formed from received data.

The Examiner finally argues that Yousef discloses forming a matrix F from the matrix S by setting to zero the values of the matrix S not set to zero during forming of the matrix $\hat{S}$. Yousef does not. The formation of the matrix S from received data implies that the matrix F is also formed from received data. However, Yousef merely describes a convolution matrix H formed from the channel impulse response, but it does not describe a convolution matrix formed from received data.

The Examiner points to column 22, lines 33-45, which discuss the Kalman gain k but does not describe the formation of any matrix remotely similar to the matrix F.

Accordingly, because Yousef does not describe forming the matrix S, the matrix $\hat{S}$, or the matrix F as recited in dependent claims 3, 7, 11, 15, 19, and 23, dependent claims 3, 7, 11, 15, 19, and 23 are not anticipated by Yousef.

CONCLUSION

In view of the above, it is clear that the claims of the present application are patentable over the art applied by the Examiner. Accordingly, allowance of these claims and issuance of the above captioned patent application are respectfully requested.

Respectfully submitted,

SCHIFF HARDIN LLP

By: ______________________________

Trevor B. Joike
Reg. No. 25,542
Attorneys for Applicants
6600 Sears Tower
233 South Wacker Drive
Chicago, IL 60606
(312) 258-5500
CUSTOMER NO. 28574

April 2, 2007